Investigating the Effective Use of Process Success Criteria in Mathematics

An Action Research Project

Directorate for Children and Young People
Lancashire County Council

Contents

Introduction

Whilst Assessment for Learning has always been good practice in many schools recent research has led to a huge impetus to promote this using certain elements. It represents formative assessment at its best, involving pupils in their own learning.

As Ofsted suggest,

'Assessment should provide the basis of informed teaching, helping pupils to overcome their difficulties and ensuring that teaching builds on what has been learned. It is also the means by which pupils understand what they have achieved and what they need to work on'

One of the key principles of assessment for learning is the use of success criteria. This is designed to help teachers and pupils assess whether a learning objective has been achieved. It is a fundamental aspect of assessment for learning that allows children and teachers to 'close the gap' between current knowledge and new learning and is recognised in the Excellence and Enjoyment materials and in the work of Shirley Clarke amongst others.

There are different types of success criteria:

- Outcome based success criteria, which consist of a statement of what the child will be able to do if they meet the learning objective, e.g.

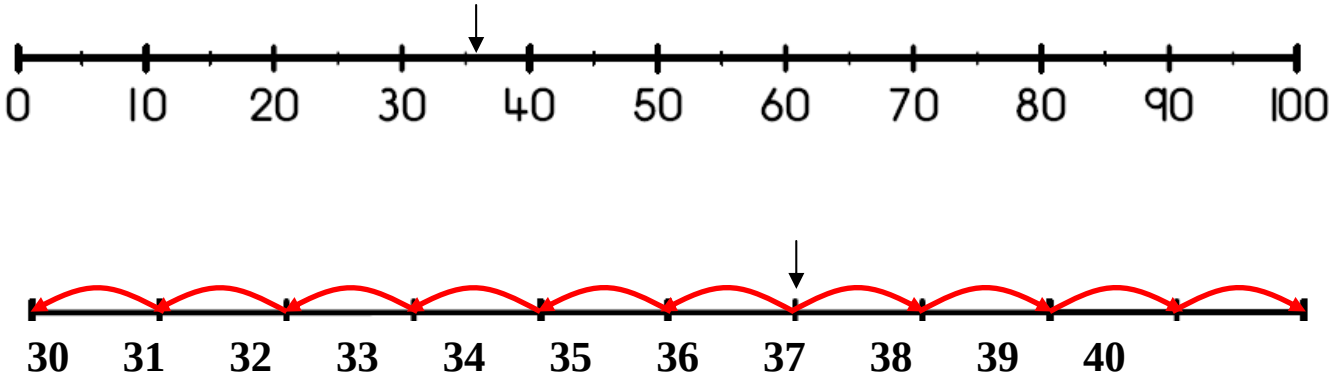
  Objective:
  To be able to round two-digit numbers to the nearest 10.
  Outcome based success criteria
  I can round two-digit numbers to the nearest 10.

- Process success criteria, which are the steps that could help the child achieve the learning objective, e.g.

  Objective:
  To be able to round two-digit numbers to the nearest 10.

  Process success criteria:
  - *Find the number on the number line*
  - *Identify the multiple of 10 at either side of the number*
  - *Count the jumps to the multiple of 10 before*
  - *Count the jumps to the multiple of 10 after*
  - *Round the number to whichever is nearest*
  - *If the last digit is 5, round the number up to the next multiple of 10*

To round 36



Which type of criteria to use depends on the skills, concepts or knowledge being taught.

Many schools have been successful in implementing success criteria as an assessment for learning strategy in literacy. They have utilised tools such as marking ladders and genre checklists to enable both pupils and teachers to evaluate work and identify next steps for improvement. These have made a significant impact on learning and teaching. Teachers tell us that they are comfortable using success criteria in a literacy lesson and more readily show what the next steps should be.

In mathematics however, the 'outcome based' success criteria is far less helpful. Success criteria in the form of 'I can' statements e.g. 'To be able to partition three-digit numbers' leading to success criteria in the form of 'I can partition three-digit numbers' were only useful in terms of enabling the children to recognise if they had achieved the objective. What this type of success criteria fails to do is support the pupil and teacher in identifying barriers preventing the child from achieving the objective; neither does it help to identify the next steps for the child.

Literacy has a 'horizon of goals'. Two children can complete a writing task but one could be a more effective piece of writing because it incorporates more sophisticated features or vocabulary. Both children have achieved the objective but one is at a higher level than the other. In contrast, most areas of mathematics are based around specific 'objective defined' aims, and as such children's responses tend to be either correct or incorrect.

The Lancashire Assessment for Learning group decided that the use of process success criteria merited further investigation and set up a school based action research project to explore this aspect of assessment for learning in more detail.

Context

Three Lancashire schools were invited to be part of the action research project. These were:

Chorley All Saints' Primary School and Nursery Unit
Grimsargh St Michael's Church of England Primary School
Tarleton Community Primary School

The schools were selected because:

- assessment for learning strategies were embedded across school
- there was an effective subject leader for mathematics
- the headteacher and leadership team were supportive of the aims of the
- project

Consideration was also given to the context in which the schools were working to provide a wider cross-section.

Background information

Chorley All Saints' Primary School and Nursery Unit

The school is smaller than average. Socio-economic deprivation is higher than in most schools. Attainment on entry is well below average. A high percentage of pupils are eligible for free school meals. The percentage of pupils with learning difficulties and/or disabilities is rising and is higher than in most schools. The percentage of pupils with a statement of educational need is increasing though still typical of most schools. More pupils join or leave the school after the reception year than in most schools. Very few children come from minority ethnic backgrounds. There are very few children whose first language is not English.
(sourced from Section 5 Inspection report 29/03/2006)

Grimsargh St Michael's Church of England Primary School

The school is a smaller than average Church of England primary school situated outside Preston, serving the local village and neighbouring urban wards. The school is graded as average on the school deprivation indicator, pupils come from a mix of socio-economic backgrounds, and are drawn predominantly from White British backgrounds. The percentage of pupils with learning difficulties and/or disabilities is lower than average. Attainment on entry is reported as broadly average. The proportion of pupils receiving free school meals is significantly below the national average.
(sourced from Proportionate Inspection Programme report 04/04/2006)

Tarleton Community Primary School

This is a larger than average primary school in the village of Tarleton, close to Preston. Most pupils are of white British heritage and a few have African or European heritage. A very small percentage are learning English as an additional language. The percentage claiming free school meals is below average. When they enter the reception class, children's attainment is about average. The percentage of pupils who have learning difficulties and/or disabilities is below average; however, the number who have statements of special educational need is well above average. The school holds the Basic Skills Quality Mark and is currently working towards the Healthy and Eco Schools awards.
(sourced from Section 5 Inspection report 24/05/2006)

Structure of the Project

The project was deliberately structured to provide opportunities for teachers to work in three phase groups across the schools:

- Upper key stage two
- Lower key stage two
- Foundation/key stage one

The subject leader in each school provided the continuity by attending all meetings. They were also provided with a research journal to document their thoughts, actions and ideas and responses from staff as the project progressed.

Schools took turns to host meetings. This enabled teachers to consider how the learning environment was being used in different contexts.

The structure of the project was as follows:

- Initial staff meeting for each school led by a consultant
- Network meeting one (1 for each phase)
- Network meeting two (1 for each phase)
- Final meeting for subject leaders

The project took place in the Spring and Summer terms 2007.

Outcomes

Initial Meeting

The initial meeting in each school gave staff information about the project. It was important that all staff had a common understanding of the different types of success criteria and how they related to mathematics.

It was suggested to participants that one model might be to generate the process success criteria with the children after the initial modelling by the teacher which would include visual and practical aids to ensure that the process would be understood rather than merely repeated.
(For further examples see Appendix 1)

Staff were also given an opportunity to discuss current practice in the schools with regard to using success criteria in mathematics. None of the schools were identifying success criteria on their planning, they did however feel that by using 'I can' statements they had been addressing some of the aspects involved. They concurred that these were not helpful in closing the gaps between current knowledge and next steps in learning.

PowerPoint notes of the initial meeting can be found in Appendix 2.

Subsequent Actions / Reflections on Progress

In one school, the initial staff meeting was followed up with a further whole school staff meeting. The subject leader wanted to ensure that the staff were confident about what they were being asked to do. She also wanted to highlight aspects of current practice that were closely linked to process success criteria to reassure staff that this was not a 'bolt on' initiative, but rather linked to what they were already doing.

Each school decided that the term 'process success criteria' was not child friendly. They preferred the term 'Steps to Success'. They felt that this had positive overtones and assumed success. In one school, this was refined to 'Steps 2 Success'. The subject leader in this school continued this theme by introducing a resource of a footprint to use to exemplify the steps. Following a child's observation, this set of resources (see Appendix 3) continued to evolve to include a table top 'Steps 2 Success' resource which meant that children had access to the process success criteria and could personalise them.

The Y2 children pictured above have just enjoyed using Process Success Criteria to carry out some calculations to find out "How much Change?" The display *(above left)* prompts the children to use the Steps2Success and self-assess.

Another mathematics subject leader was using the Pick and Mix Strategy cards devised by Lancashire Mathematics Team (see Appendix 4) with her class. Each child kept a strategy book to enable them to refer to these during lessons. The process success criteria were then added to this book as an ongoing resource where appropriate objectives were being taught.

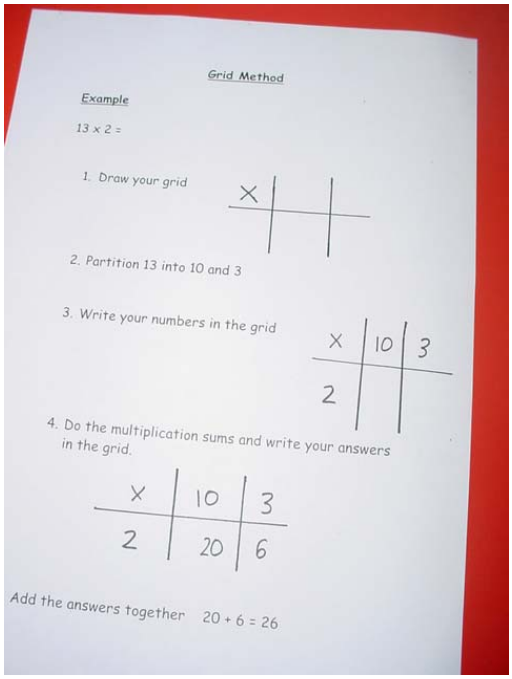
Teachers in this school were encouraged to explore their ideas independently before feeding back at the next meeting.

All schools realised that they were already incorporating disparate elements of process success criteria into their practice and felt that being involved in the project allowed them to make it more cohesive.

Network Meeting One

This series of meetings was hosted by each school in turn. These meetings gave teachers the opportunity to share their ideas. Feedback indicated that this professional dialogue with colleagues from both their own and other schools was a particularly valued part of the project.

Mathematics subject leaders felt that this exchange of ideas and resources acted as a stimulus for some teachers who had been quite passive during the first phase of the project. The footprint idea was one that was very well received by teachers in all phase groups who were keen to try this idea with their own classes.



Example of process success criteria used to teach the grid method of multiplication.

Teachers raised concerns about what they identified as barriers to the use of process success criteria in mathematics. One was the way in which these were communicated to the children. This was felt especially in Foundation and Year one who found that relying on a narrative had little impact, whereas a visual and verbal model was more effective.

In some areas, the use of process success criteria was unhelpful for various reasons. It could be too wordy, it could be difficult to unpick into individual elements or it could be a set of prompts rather than a process. For example, for the Y4 objective 'Visualise 3-D shapes from 2-D drawings', teachers can prompt children to consider the faces on the drawing to enable them to

identify the solid. If the child cannot visualise the 3-D shape, there is no single process they can go through to assist with this, it is more of a 'If it has … then it is …' set of options which rely more on memory and recall.

This meeting provided the project with more impetus. Teachers had the reassurance that what they had been trying had been experienced by others and were confident to try ideas suggested in their own classes.

As an outcome of the first network meeting all schools were asked to consider the following points in the next phase of their action research. When using process success criteria:

- Is it helpful for all children?
- Is it appropriate for all areas of the mathematics curriculum?

Subsequent Actions / Reflections on Progress

One school observed that it had a positive impact on assessment especially in pupil feedback. Rather than saying 'I can't do decomposition' or 'I can't do the grid method' it allowed children and teachers to identify which aspect of a concept or skill the child had difficulty with. For example, with difficulties in grid method, the teacher and child might identify that the child could not use related facts. Teachers observed that this brought the barrier to learning into much sharper focus and therefore made it a more manageable step to overcome.

From the teacher's perspective this process of diagnostic assessment enabled them to select appropriate intervention strategies and/or resources to support the child in overcoming this gap in knowledge or misconception. Wave 3 materials (Supporting Children with gaps in their Mathematical Understanding - Ref: DfES1168-2005G) were mentioned as a useful tool in supporting this process.

From the child's perspective it greatly increased their confidence and motivation. Many children stopped using comments such as 'I can't do maths' and began to say 'I can do this part, but I'm stuck on this step'. Being able to identify this step engaged them to a far greater extent in talking about their mathematics.

All schools were now using the 'Steps 2 Success' and footprint idea refined to suit individuals.

The mathematics subject leader who was using the strategy book idea with her mixed Y3/4 class extended this idea across key stage 2.

When reflecting on the how long it took to explore and develop process success criteria most teachers felt that it was a good investment in time. Some teachers noted that it often took a whole lesson to generate process success criteria with the children, especially at the beginning of a new unit of work or introduction of a new concept. Some concerns were expressed about this in terms of the current model of planning where a unit tends to last a week. However, there was a consensus that this model of exploration linked very well to the structure of the renewed framework, particularly the idea of exploring prior learning.

Some teachers commented that some higher ability children felt that their progress was being restricted by following all of the steps given in the process. One child commented 'It is useful when first learning but it is not useful for me because I know it.'
To prevent the higher ability and more confident children being 'held back', some teachers found it more successful to generate process success criteria in the plenary of the first lesson in a unit. One subject leader in particular felt that this encouraged more independence and self evaluation, especially for these children who could create more a succinct range of steps for their own use if they were needed at all.

Network Meeting Two

At network meeting one, teachers had been asked to consider:

- Is process success criteria helpful for all children?

Teachers had already started to consider the appropriateness of process success criteria for higher ability children and those who were confident with particular aspects of mathematics. Both teachers and children felt that being engaged in generating process success criteria held them back because they did not need it. However, some children in this category found it difficult to verbalise their learning or to explain their thinking. One mathematics subject leader noted in her journal:

> 'One of my "most able" boys found it very difficult to verbalise for him the steps were ingrained but he couldn't transfer these orally. The whole process visibly frustrated him.'

Teachers were concerned that there was a need to develop the mathematical oracy of all children, including those who had a tendency to verbalise explanations as 'I just know'. Although these children did not need to use process success criteria to achieve success, they did need to explain their process or steps.

For lower ability children and those with SEN teachers felt that the use of clear steps to success was supportive of learning if it was presented in a way that was accessible to them. Often, unsurprisingly, reading could be a barrier so teachers had explored other ways of communicating, using oral communication, photographs, models, images and practical resources as alternative methods.

Foundation and key stage 1 teachers also found that using a list of steps was inaccessible to many of the children in their classes. Children responded more readily to oral, practical and visual models, similar to those mentioned above.

These Y1 children *(to the left)* find mathematics quite easy but they still like to use the STEPS to remind them.

The Y1 teacher keeps the STEPS simple. They are more like generic prompts, rather than for specific processes.

There was an agreement that use of process success criteria was most effective when used to support the learning of children who were working slightly below age-appropriate expectations and less confident pupils. This was because it gave these children the confidence to 'have a go' at mathematics within a defined and structured framework. Because they had access to a list of steps they became less dependent on an adult to guide them individually through each step in the process. It also encouraged them to be more self-evaluative and able to identify exactly where they were stuck.

When working with her small group of Y1 children, this Teaching Assistant, finds that using the STEPS2SUCCESS helps them to focus on their task.

Teachers had also been asked to consider:

- Is process success criteria appropriate for all areas of the mathematics curriculum?

Teachers reflected on an earlier observation that for some areas of mathematics, attempting to generate process success criteria felt contrived and unhelpful, for example when visualising 3-D shapes from 2-D drawings.

> *In some areas, the use of process success criteria was unhelpful for various reasons. It could be too wordy, it could be difficult to unpick into individual elements or it could be a set of prompts rather than a process. For example, for the Y4 objective 'Visualise 3-D shapes from 2-D drawings', teachers can prompt children to consider the faces on the drawing to enable them to identify the solid. If the child cannot visualise the 3-D shape, there is no single process they can go through to assist with this, it is more of a 'If it has … then it is …' set of options which rely more on memory and recall.*

They had now had the opportunity to explore more areas of the curriculum and agreed the following points:

It was especially useful for:

- aspects of place value, ordering and rounding, e.g. multiplying or dividing by
- 10/100/1000
- many aspects of calculation, including written methods
- areas of the measures curriculum, such as measuring angles using a
- protractor, using a ruler, calculating area and perimeter and reading a scale
- aspects of shape such as reading and plotting coordinates
- constructing graphs and diagrams, including Venn and Carroll diagrams
- solving word problems, i.e. carrying out the calculation once it has been
- identified

but was less helpful when:

- exploring properties of number or shape
- interpreting data
- solving word problems, i.e. identifying the operation

Teachers felt that a good rule of thumb when deciding whether the use of process success criteria would be helpful was to identify if the area of mathematics was based around a sequence of steps. If that was the case then it would be more appropriate. This works mainly when the barrier to children's learning is remembering the steps, not the understanding of the concept. The use of process success criteria does not support children in understanding mathematical concepts or remembering key facts.

As an outcome of the second network meeting all schools were then asked to consider the following points in the next phase of their action research.
When using process success criteria:

- Is it appropriate to for teachers to note process success criteria on plans?
- Are there implications for mathematics subject knowledge?

Subsequent Actions / Reflections on Progress

Teachers had been asked to consider:

- Is it appropriate to note process success criteria on plans?

There were mixed responses to this issue. One subject leader strongly felt that noting them on plans was not an effective use of teachers' time. The model of generating in their school was for pupils to develop their own in the plenary of the first lesson in the unit. She felt, however that it was important for teachers to have thought through the process themselves prior to the lesson to ensure that all key steps were identified by the children.

Other subject leaders felt that identifying criteria on plans was a well embedded aspect of planning in their schools. Noting process success criteria on plans was concrete evidence that teachers had engaged in this thought process. If process success criteria are noted on the plans in the autumn term, then these could be easily referred to and refined in subsequent terms as children revisited these areas of mathematics.

Teachers had also been asked to consider:

- Are there implications for mathematics subject knowledge?

It became apparent to subject leaders that some teachers were more comfortable with identifying process success criteria than others. This was linked to their subject knowledge and awareness of the progression in learning in different areas of mathematics.

Conclusion

To draw conclusions, the group evaluated the impact of the project on different areas.

Impact on pupils

- Teachers found that many pupils gained in confidence through using process success criteria because it allowed them to identify their particular areas of difficulty rather than using global statements such as 'I can't do maths.' This then led to children being able to focus on their own successes
- Children became much more independent and asked for help on specific areas rather than the whole process.
- Having steps to learning made self and peer marking a more robust process. Rather than reflecting on whether they had achieved the whole skill, children could identify small parts of strengths and areas for development which led to better quality and more honest feedback.
- Through discussion of the steps to success as part of the maths lesson, it enabled teachers to model and promote mathematical vocabulary. This then encouraged the children to use appropriate terminology in discussing their mathematics.
- Identifying steps to learning helped with booster classes as it meant that the session foci could be more tailored to the children's own needs.

Impact on teachers

- Teachers found that they were able to mark more effectively because they were focusing on the process success criteria rather than general features of the work.
- It was easier to identify next steps in learning for all groups of pupils based upon their unsuccessful steps.
- Many teachers found that using process success criteria clarified the progression of learning in their own minds before teaching.
- Expectations were more focused and therefore potentially higher.
- Teachers were able to see the benefits of embedding the whole AfL cycle and how each part linked to others and this gave a greater cohesion to the process.
- Teachers found that plenaries had a greater benefit as they were more focused on the steps to learning and evaluating successes and areas for development.
- Using this model supported flexible approaches when planning from the renewed framework using the cycle - Review - Plan - Teach - Consolidate - Apply – Review. It enabled teachers to pinpoint more precisely those areas which needed to be consolidated or reviewed.

- Through the use of process success criteria it was possible to have a more refined/focused dialogue between teachers and teaching assistants regarding specific children and their needs.

Impact on Teaching Assistants

- Through the use of process success criteria, teaching assistants were provided with more focused notes on how to communicate ideas to children and the steps to learning.
- It facilitated professional dialogue with teachers which was more focused on the specific mathematical needs of children.
- Many teaching assistants found that using these methods gave them a better structure and therefore more confidence with working with mathematics.
- Teaching assistants reported improved subject knowledge through working through the steps themselves.

Impact on Mathematics Subject Leaders

- Subject leaders were able to undertake more focused monitoring.
- Subject leaders found that it gave them greater confidence through leading the initiative in school, as they were more aware of what was happening in other classes.

Impact on Home/School Partnership

- The use of process success criteria supported parents when helping with homework, particularly with areas such as written calculations.

Impact on The Learning Environment

- The classroom environment was used to support learning more effectively by displaying the steps to learning and worked through examples.
- Children were able to identify where to look for support with topics.

Impact on Standards

Due to the short term nature of this project, it was difficult to draw conclusions relating to standards using quantitative measures. That said, there was some evidence to suggest that there will be a positive impact on measurable standards:

- Evidence on SATs papers shows more children using methods, particularly calculation that they had been shown - and were correct.
- Almost all the children attempted all the questions, in the past they may not have done this – therefore there has been an impact on confidence.

Barriers

The use of process success criteria is not a panacea for all aspects of underperformance in mathematics. The group also identified some potential barriers to learning that may occur.

- The line between structure and rigidity/flexibility is a narrow one, and it is important not to become too rigid when using process success criteria. It may turn some of the children off learning if they have to follow each step of the process, especially more able, as previously identified.
- Children may become over reliant on them, and therefore unable to function when not given a set of process success criteria
- It did not lend itself to all areas of mathematics, so trying to impose it in every lesson would be counter productive
- It was effective where teachers had the confidence and the subject knowledge to work through the process and could identify the next steps in learning
- It would be potentially difficult to use with a mixed age/stage class in terms of moving some children on when others are at a different stage of learning. This could however be managed through group work.

Recommendations

If the use of process success criteria is to work, assessment for learning needs to be well established in school.

The end goal is about the learning and the links in learning, so children need to understand that ultimately they need to work independently without relying on the steps in place. Some teachers felt that the more flexible approach, with regard to timing, of the renewed frameworks will help children with consolidation time so that they can make use of the process success criteria but still become independent learners.

If higher ability children don't need to use process success criteria, teachers should ensure that they are still able to explain methods and strategies, which promotes the use of vocabulary.

Teachers should not agonise over putting the process success criteria in place in every unit/ topic. Some, like aspects of shape, just don't lend themselves to the process. If it's not going to enhance the children's learning, don't do it!

As has been identified, it was particularly useful when working with methods of written calculation. To that end, schools should have a written calculations policy in place that is being followed by all staff for the use of process success criteria to be successful.

The implementation of the use of process success criteria in maths should be supported by the senior leadership of the school. This will ensure that time is given to allow the mathematics subject leader to discuss with and support other teachers.

There is no one fixed model to implementing the use of process success criteria in mathematics. The schools in the project had some elements in common, but did not use identical approaches. Schools should apply the elements flexibly and develop them to fit their school situation. Each school should agree on certain 'non-negotiable' elements, e.g. format, name etc to promote and ensure consistency.